

CLAIMS

What is claimed is:

- 1 1. A thermal liner for use in a protective garment, the liner comprising:
2 an insulation layer comprising a batt of entangled flame resistant fibers, the
3 insulation layer having a three-dimensional pattern that defines a plurality of closed-cell
4 air pockets that are configured to trap air to insulate a wearer of the thermal liner, the
5 insulation layer being shaped and configured for inclusion in the protective garment and
6 for donning by the wearer.

- 1 2. The thermal liner of claim 1, wherein the batt comprises at least one of
2 aramid, melamine, FR rayon, modacrylic, and carbon fibers.

- 1 3. The thermal liner of claim 1, wherein the closed-cell air pockets are
2 formed on an inner side of the insulation layer adapted to face the wearer.

- 1 4. The thermal liner of claim 1, wherein the closed-cell air pockets are
2 defined by boundary walls.

- 1 5. The thermal liner of claim 1, wherein the closed-cell air pockets comprise
2 repeated geometric shapes.

1 6. The thermal liner of claim 5, wherein the repeated geometric shapes
2 comprise at least one of honeycombs, circles, and triangles.

1 7. The thermal liner of claim 1, wherein the closed-cell air pockets have
2 transverse dimensions within the range of about 1/16 inches to about 1/2 inches and depth
3 dimensions within the range of about 1/8 inches to about 5/16 inches.

1 8. The thermal liner of claim 1, wherein the insulation layer has a weight in
2 the range of about 0.75 ounces per square yard to about 8 ounces per square yard.

1 9. The thermal liner of claim 1, wherein the insulation layer has a weight in
2 the range of about 1.5 ounces per square yard to about 2.7 ounces per square yard.

1 10. The thermal liner of claim 1, comprising multiple insulation layers, each
2 insulation layer comprising a batt of entangled flame resistant fibers and having a three-
3 dimensional pattern that defines a plurality of closed-cell air pockets that are configured
4 to trap air to insulate the wearer of the thermal liner.

1 11. The thermal liner of claim 1, further comprising a facecloth layer that is
2 attached to the insulation layer, the facecloth layer comprising a plurality of flame
3 resistant fibers.

1 12. The thermal liner of claim 11, wherein the facecloth layer is attached to an
2 inner side of the insulation layer such that the closed-cell air pockets of the insulation
3 layer face the facecloth layer.

1 13. The thermal liner of claim 11, wherein the facecloth layer comprises at
2 least one of aramid, melamine, FR rayon, modacrylic, and carbon fibers.

1 14. The thermal liner of claim 11, wherein the facecloth layer comprises a
2 hydrophilic finish.

1 15. A thermal liner for use in a protective garment, the liner comprising:
2 an insulation layer comprising a batt of entangled flame resistant fibers, the
3 insulation layer having a three-dimensional geometric pattern provided on an inner side of
4 the insulation layer that forms a plurality of closed-cell air pockets that are defined by
5 boundary walls and that are configured to trap air to insulate a wearer of the thermal liner;
6 and
7 a facecloth layer that is attached to the inner side of the insulation layer, the
8 facecloth layer comprising a plurality of flame resistant fibers;
9 wherein the thermal liner is shaped and configured for inclusion in the protective
10 garment and for donning by the wearer.

1 16. The thermal liner of claim 15, wherein the batt comprises at least one of
2 aramid, melamine, FR rayon, modacrylic, and carbon fibers.

1 17. The thermal liner of claim 15, wherein the closed-cell air pockets have
2 geometric shapes that comprise at least one of honeycombs, circles, and triangles.

1 18. The thermal liner of claim 15, wherein the closed-cell air pockets have
2 transverse dimensions within the range of about 1/16 inches to about 1/2 inches and depth
3 dimensions within the range of about 1/8 inches to about 5/16 inches.

1 19. The thermal liner of claim 15, wherein the insulation layer has a weight in
2 the range of about 0.75 ounces per square yard to about 8 ounces per square yard.

1 20. The thermal liner of claim 15, wherein the insulation layer has a weight in
2 the range of about 1.5 ounces per square yard to about 2.7 ounces per square yard.

1 21. The thermal liner of claim 15, comprising multiple insulation layers, each
2 insulation layer comprising a batt of entangled flame resistant fibers and a three-
3 dimensional pattern that defines a plurality of closed-cell air pockets that are configured
4 to trap air to insulate the wearer of the thermal liner.

1 22. The thermal liner of claim 15, wherein the facecloth layer comprises at
2 least one of aramid, melamine, FR rayon, modacrylic, and carbon fibers.

1 23. The thermal liner of claim 15, wherein the facecloth layer comprises a
2 hydrophilic finish.

1 24. A protective garment, comprising:
2 an outer shell formed of a flame and abrasion resistant material;
3 a moisture barrier formed of a flame resistant material; and
4 a thermal liner including an insulation layer comprising a batt of entangled flame
5 resistant fibers, the insulation layer having a three-dimensional pattern provided on an
6 inner side of the insulation layer that forms a plurality of closed-cell air pockets that are
7 configured to trap air to insulate a wearer of the protective garment.

1 25. The protective garment of claim 24, wherein the insulation layer batt
2 comprises at least one of aramid, melamine, FR rayon, modacrylic, and carbon fibers.

1 26. The protective garment of claim 24, wherein the closed-cell air pockets of
2 the insulation layer comprise repeated geometric shapes.

1 27. The protective garment of claim 26, wherein the repeated geometric
2 shapes comprise at least one of honeycombs, circles, and triangles.

1 28. The protective garment of claim 24, wherein the closed-cell air pockets of
2 the insulation layer have transverse dimensions within the range of about 1/16 inches to
3 about 1/2 inches and depth dimensions within the range of about 1/8 inches to about 5/16
4 inches.

1 29. The protective garment of claim 24, wherein the insulation layer has a
2 weight in the range of about 0.75 ounces per square yard to about 8 ounces per square
3 yard.

1 30. The protective garment of claim 24, wherein the insulation layer has a
2 weight in the range of about 1.5 ounces per square yard to about 2.7 ounces per square
3 yard.

1 31. The protective garment of claim 24, wherein the insulation layer comprises
2 a facecloth layer that is attached to the inner side of the insulation layer, the facecloth
3 layer comprising a plurality of flame resistant fibers.

1 32. The protective garment of claim 31, wherein the facecloth layer comprises
2 at least one of aramid, melamine, FR rayon, modacrylic, and carbon fibers.